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Research Note
UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
INTERMOUNTAIN FOREST & RANGE EXPERIMENT STATION
OGDEN UTAH

U.S. Forest Service
Research Note INT-59

1967

PRODUCTIVITY INDICATORS IN WESTERN LARCH FORESTS[1]

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ABSTRACT

Classification of land productivity, often neglected because of complexities in the conventional site index methods, can be done simply in larch forests by using plant indicators. Western larch (Larix occidentalis Nutt.) stands growing on several of the ecological habitat types as defined by Daubenmire have significantly different mean site indices. The habitat method will not replace the more precise conventional site index determination for individual stands.

Classification of land productivity is an important management tool that is often neglected because it is difficult to measure under varying stocking conditions in forests. Site index, a common means of rating forest land productivity, is ordinarily determined by measuring dominant and codominant trees in normally stocked stands. Trees must be measured in the same proportion of dominance classes as that found in the data from which the site curves were made. Site index is then determined from the height-over-age curves by extrapolating to an index age (50 years for western larch (Larix occidentalis Nutt.)).

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[1] Special acknowledgment is due the J. Neils Lumber Company for valuable assistance in planning the study and collecting the data.

Current management studies show that ecological habitat types,[2] which can be easily and quickly recognized on the ground, provide a practical tool for broadly classifying productivity of larch stands. The method is also useful on areas that are denuded or where too few site trees are present. Daubenmire has developed a concise, practical guide[3] as an aid in classifying ecological habitat types, for such types serve as vegetative indicators of site quality.

COLLECTION OF DATA

The data reported here were collected on 363 plots during a survey of larch pole trees throughout western Montana, northern Idaho, and northeastern Washington to determine significant management factors. In each stand sampled, one or more trees that contained a transmission pole were selected as plot centers. Detailed measurements were then made on these sample trees, while site information was determined on concentric .2-, .1-, and .001-acre plots, using each sample tree as a common center. The ecological habitat type[4] was determined by examining the vegetation on each .2-acre plot and in the immediate vicinity. The ecological habitat type on each plot was classified by one of several persons trained to recognize such types. Although the habitat types were developed in northern Idaho and adjacent Washington, our experience indicates that they can be identified in western Montana as well. Two to four average dominant larch site trees, including the sample tree, were selected; d.b.h., total age, and total height were recorded. Site index (the total height at age 50 years) was determined for each plot by extrapolation on unpublished height/age curves developed from normal plot data collected by L. J. Cummings in 1937.[5] These data form the basis for the analysis in this report.

ANALYSIS OF DATA AND RESULTS

Difference in mean site indices between all ecological habitat types was shown by "t" tests to be highly significant except between *Thuja Tsuga/Pachistima*, *Thuja/Pachistima*, and *Abies grandis/Pachistima*. Because these three types are moist, highly productive sites, the data were combined, and the mean of the combined types was significantly different from means of all the other types. The mean site indices for ecological habitat types are tabulated below:

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[2] Daubenmire, R. Forest vegetation in northern Idaho and adjacent Washington and its bearing on concepts of vegetation classification. Ecol. Monogr. 22: 301-330. 1952.

[3] Daubenmire, R. The use of vegetative indicators in the forests of northern Idaho and northeastern Washington. Typewritten, unpub., 3 pp., Wash. State Univ., Pullman, Wash. (n.d.)

[4] Ibid.

[5] Cummings, L. J. Larch-Douglas fir board-foot yield tables. U.S. Forest Serv. Northern Rocky Mountain Forest and Range Exp. Sta., Applied Forestry Notes 78, 3 pp.+, illus. 1937.

Ecological habitat type	Mean site index	Confidence interval P = .99
Picea-Abies/Xerophyllum	49.1	±2.08
Picea-Abies/Pachistima	58.2	±2.56
Thuja-Tsuga/Pachistima) *Thuja/Pachistima*) *Abies grandis/Pachistima*)	66.3	±1.35
Pseudotsuga/Physocarpus	62.2	±4.46
Pseudotsuga/Calamagrostis	54.6	±1.50

Covariance analysis of the site tree data confirms the above analysis. Ages in the stand sampled ranged from about 30 to more than 200 years. Errors may have been introduced into the plot site index determinations when the plot heights for the broad age ranges were extrapolated by means of average-height-over-age curves. Nevertheless, the mean total height of the site trees also showed a highly significant difference when adjusted for age differences by covariance methods between habitat types. Furthermore, it is interesting to note that this analysis suggests polymorphism among the height-over-age curves for the several habitat types. As illustrated in the summary of the analysis shown in table 1, the variation among regression coefficients was significant.

Hundred-year-old western larch crop trees reach an average total height of about 108 feet in the highly productive *Thuja Tsuga/Pachistima* and *Abies grandis/Pachistima* habitat types. On the other hand, crop trees of the same age in the relatively dry, cool *Picea-Abies/Xerophyllum* habitat type average slightly less than 84 feet. Heights reached by larch crop trees in the other habitat types fall between these extremes.

Table 1.--Summary of covariance analysis of height over age by habitat type

Source of variation	d.f.	Deviations from regression		
		Sums of squares	Mean squares	F.
Within	1059	359.92674		
Regression coefficient	6	13.64455	2.27409	6.483 significant
Common regression	1065	373.57129	.35077	
Means	6	115.83943	19.30657	55.041 highly significant
Total	1071	489.41072		

DISCUSSION

The ecological habitat classification cannot replace the more precise conventional method of determining site index for individual stands because site indices vary considerably within each of the ecological habitat types. Our belief in the usefulness of this classification as a management tool is supported by the fact that even though several persons classified plot vegetation in this study, the data produced highly significant results. Development of individual growth curves for habitat types might refine the estimate of productivity. In its present form, the habitat method provides a simple, useful means of rapidly assessing the relative productivity of large areas. Further refinement would require more data, which would only increase the complexity of its use.

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